**Differential Equations – applications**

Example 1: Rate of change is a function of time

General Solution

Differential equation

**Question:** The full volume of an inflatable mattress is 240 000 cm3 and the rate at which

the volume is deflating is given by: cm3/s . What volume of air will remain

in the mattress after 10 seconds?

So [using the modulus sign only for the initial solution is sufficient]

Since the initial () volume is 240 000 cm3, the constant will be found using:

So the expression for the volume in the inflatable mattress is:

Therefore the volume of air that remains in the mattress after 10 seconds is:

cm3.

Example 2: Rate of change is directly proportional to the value itself

General Solution

Differential equation

The proof of the general solution to this differential equation:

[ is a constant and can therefore be replaced with a letter, in this case . ]

Applications of this type of differential equation could include growth and decay, inflation, Newton’s law of cooling etc.

**Question**: A microbiologist finds that for the one-celled *Paramecium* organism, the growth rate of a colony is given by the differential equation: where the number of *Paramecia* in the colony, and time in hours. Solve the equation to find the general solution. If the initial population of *Paramecia* is 200, how many *Paramecia* will there be in 24 hours?

which is the general solution to this type of differential equation.

Since the initial () population is 200, the constant will be found using:

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So and the general equation for the population of the colony is:

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Therefore the number of *Paramecia* after 24 hours is:

Worksheet Ex 3.2C M7